URBAN TECHNOLOGY NETWORKING

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URBAN TECHNOLOGY NETWORKING

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SUMMARY

Urban technology networking as a method to bring innovative technology to local governments is based on the premise that sensible utilization of existing and available technology at the local level will help to provide additonal and improved services, usually at a lower cost. Urban technology networking relies on well-defined institutional and organizational arrangements and mechanisms called urban information and technology transfer networks.

The thesis attempts to answer the following questions:

(1) What are the predominant characteristics and features of operational urban information and technology transfer networks?

(2) How do these characteristics and features relate to the goals and objectives?

(3) How should the characteristics and features of the networks be altered to improve overall performance?

(4) What should an alternative network-design look like using the modified characteristics and features as building elements?

Based on a description of the concepts and a typology of urban information and technology transfer networks, five operational networks are analyzed, classified, compared, and critiqued. The typology is used to focus the criticism on the functional elements and characteristics of transfer networks. Modifications to the elements are recommended leading to the design of an alternative network. The alternative network consists of four major components: (1) a computerized on-line technology information system, (2) science and

technology advisory groups at the local level consisting of members of the local professional communities, (3) pools of research and development organizations by field of specialization for network back-up support, and (4) a network-office under the direction of representatives of various public interest groups and professional associations.

CHAPTER I

INTRODUCTION

Background

Urban technology networking is a recent attempt to help local governments particularly in urban environments, solve the ever increasing number and difficulty of problems in delivering services in an efficient and effective way. The problems primarily originate from the current local cost-revenue squeeze. Local governments are facing a steady rise in demand for additional and improved services. Yet, revenues do not keep up with the rising costs for these services.

Technology networking as a method to bring innovative technology to local governments is based on the premise that sensible utilization of existing and available technology at the local level will help to provide additional and improved services, usually at a lower cost. Urban technology networking relies on well-defined institutional and organizational arrangements and mechanisms called urban information and technology transfer networks. These networks usually consist of local governments and research and development (R&D) organizations linked together by a central office. The purpose of the networks is basically to enhance and improve the utilization of technology applicable to public sector needs at the local level.

Utilization of innovative technology in the public sector was and still is to a certain degree hampered by various factors:

- Local government staffs do not have adequate science and technology capabilities.

- Only a small amount of investment in research and development both by industry and by the federal government is aimed at meeting local governments' needs.
- Local governments find it difficult to express their views to influence federal research and development priorities.
- Adequate information exchange mechanisms about successful technology innovations at the local level do not exist.
- Little useful knowledge about how innovation takes places at the local level is available.

Urban information and technology transfer networks try to overcome these and other barriers to technology utilization at the local level.

Unlike most federal mission agencies' technology transfer mechanisms, urban information and technology transfer networks are run by participating local governments. Supported by public and/or private research and development organizations and the networks' offices, these local governments define their technological problems, assess their needs and actively search for existing suitable technological solutions or even develop new technologies. Direct and indirect communication and cooperation linkages are maintained among all participating local governments and R&D organizations on a continuing basis.

Questions

Since 1971 when the National Science Foundation and the National Aeronautics and Space Administration established the California Four Cities Program as the first urban information and technology transfer network, numerous networks have developed with a variety of different characteristics and features. All of them are still in their experimental stages and receive financial support for

their operations primarily from the National Science Foundation.

This thesis attempts to answer the following questions:

(1) What are the predominant characteristics and features of operational urban information and technology transfer networks?

(2) How do these characteristics and features relate to the goals and objectives?

(3) How should the characteristics and features of the networks be altered to improve overall performance?

(4) What should an alternative network-design look like using the modified characteristics and features as building elements?

Approach

This paper systematically establishes the groundwork for designing an alternative urban information and technology transfer network. The basic concept of networking and information and technology transfer will be discussed in Chapter II. A tool to classify operational networks and to describe their main features and characteristics will also be developed. This typology will then be used to structure the chapters that follow. It is assumed that, since the typology can describe any kind of operational urban information and technology transfer network, it immanently defines any future alternative alternative network to be developed.

Chapter III describes five operational networks which are selected to demonstrate all known features and characteristics of transfer networks. The typology will be applied to allow a comparative overview of the five networks.

Chapter IV combines comments and criticism of network users, network managers, NSF officials and other technology transfer experts in a critique of the

five operational networks. The typology will be used to focus the criticism on the functional elements and characteristics of transfer networks. Modifications and additions to the elements discussed will be recommended.

In Chapter V, the recommendations are blended with the typology to design an alternative network. Network user characteristics, the kind of services provided, and the functional elements of the network will be described.

The final recommendations summarize the answers to the questions mentioned above and show how the alternative network-design could fit into the national urban information and technology transfer environment.

CHAPTER II

CONCEPT OF URBAN INFORMATION AND TECHNOLOGY TRANSFER NETWORKS

This chapter provides the basis for the discussion of five operational networks, their critique, and the design of an alternative network. A definition of urban information and technology networks is given. The concepts and philosophies underlying networks are described, and an instrument to classify operational networks is developed.

Definition

Structure

Urban information and technology transfer networks consist of several components: local jurisdiction, private and/or public research and development (R&D) organizations and a central network office. The term network refers to the interrelationships among these components. Various forms of interrelationships can be found: formal and informal communication linkages, contractual agreements, and cooperative research and development efforts. Unlike hierarchically structured transfer systems, networks emphasize interrelationships among all components involved (Figure II-1). Urban information and technology transfer networks are particularly useful in building communication and cooperation linkages among the local jurisdictions to be served.

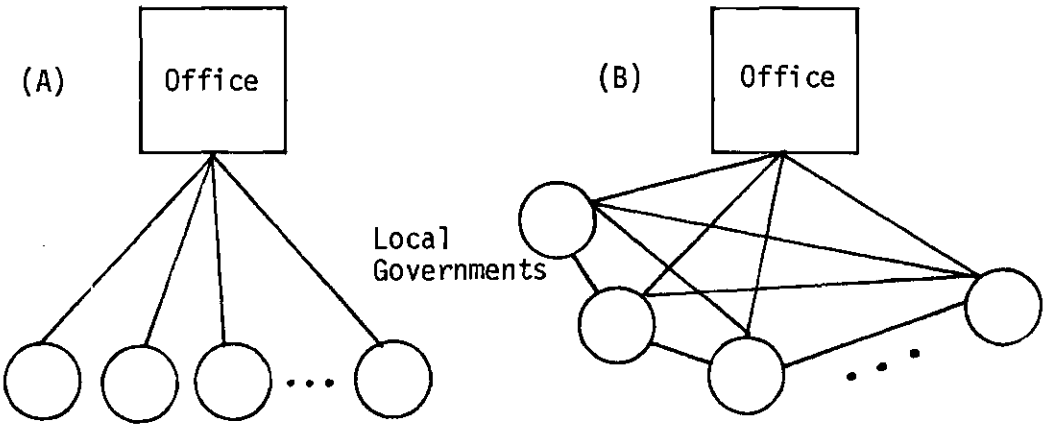

Figure II-1. Schematic Diagram of a Hierarchically Structured Transfer System (A), and a Network (B).

Purpose

Urban information and technology transfer networks operate with the following goals and objectives:

(1) To serve public needs effectively and economically by

- increasing the productivity in the delivery of public services;
- improving the quality of services provided by local governments;
- improving the decision making and planning capability of local government
- officials; and improving the operation of local administrations.

(2) To stimulate research and development activities in the public technology sector by federal agencies, laboratories and private industry by

- identifying local governments' problems and assessing their needs;
- assigning priorities to local governments' needs;

- aggregating the public sector market; and
- assisting federal agencies and private industry in marketing their services and products.

(3) To increase the utilization of technology innovations at the local level by

- demonstrating potential benefits of utilizing technology;
- proof-of-concept by testing in selected sites;
- stimulating inter-jurisdiction communication and cooperation; and
- repeating successful technology innovations at different locations.

Services

Networks do not only provide urban technology but also information on the technology. The term technology includes all types of new ideas and/or concepts, such as improved processes, equipment, and products, that might be applied to local government functions to increase effectiveness and efficiency. The overall concept of technology embraces "soft" technology including improved operations, procedures and management methods as well as "hard" technology such as new equipment for solid waste collections, and new improved computer facilities.

Barriers to Technology Utilization

Urban information and technology transfer networks in trying to improve the technology flow and utilization in local governments have to overcome several major barriers.

Cost. A major barrier to moving technology more quickly into the public sector is cost. Most local governments cannot afford the costs of defining their problems, relating them to technological needs, and finding and utilizing available technological resources to solve the problems. Furthermore, technology developed by private industry must often be adapted for use in the public sector which adds additional costs to technology utilization. The costs can be divided

into three categories: (1) actual technology; (2) description, training, manuals; and (3) personnel and expertise required to install and utilize the technology.

Other possible inhibitive factors beyond the dollar cost of innovative technology include local governments' financial policies, budgeting priorities, degree of economic risk involved in technology acquisition, recent investment in existing facilities, and expenditures justification.

Political Environment. Another barrier to the movement of technology from the private to the public sector is the political environment itself. Many local officials depend on election or appointment for employment. They therefore perceive the process of acquiring technology as too risky, troublesome, time-consuming and/or costly, to produce sufficient benefits during their term of office. Inhibiting factors also include influences exerted by the elected officials on the local administration, reaction of local interest groups, and media effects on public opinion.

Awareness and Attitudes. Lack of awareness on the part of local officials concerning the availability of innovative technology, its capabilites and the potential benefits accruing from its utilization constitutes another barrier to the technology flow to the public sector. Attitudes of those within local governments who influence the decision to use technology can be another major barrier.

Regulations. Rules, regulations and laws imposed on local governments and their administrative entities by higher levels of government, competitive bidding requirements, specifications, purchasing policies, and local codes and standards can considerably inhibit if not stop the flow and utilization of innovative technology.

Technology Transfer

Technology transfer is a highly complex process involving a wide variety of interactive elements. Samuel Doctors offers the following description. Technology transfer is

> . . . the process whereby technical information originating in one institutional setting is adapted for use in another institutional setting. The transfer typically requires active participation by both the transferor and the transferee and implies more than a mere dissemination of technical information; it implies the adaptation of new technology through creative transformation and application to a different end use. (Doctors, p. 3)

Urban information and technology transfer networks equally treat information and technology as object or transfers. However, it must be emphasized that information transfer in itself is not sufficient to induce a successful technology transfer. Dr. Peter Chenesy stated:

> Whereas information transfer is an essential part of technology transfer, much information is transferred but never put to any application. A technology transfer occurs when machines, materials, or methods are actually used to perform a new task. (Chenesy, p. 2)

Technologies tend to be developed to meet particular needs within particular industries, or the society as a whole. Often, these same technologies can be utilized in other industries and governmental sectors to meet other needs. By adapting existing technologies to new problems rather than developing new ones, technology transfer organizations avoid "reinventing the wheel". By the same token time and money can be saved.

Urban information and technology transfer networks employ an active transfer mechanism. Active technology transfer mechanisms usually involve the participation of technology agents or imply the personal interaction between the developers and the users of technology. The technology agent assists a potential technology user, in this case a local government, by identifying its problems and

defining its needs. The agent identifies appropriate technologies which might solve the problems. He promotes the communication between the local government and the supplier, so that particular technologies will be adapted to the specific problems.

The technology agent concept is a very important part of the active transfer mechanism. It requires the employment of skilled individuals to form dynamic links between the developers of technology and its users. Samuel Doctors stated: "Personal contact is significantly more important than the mere dissemination of literature." (Doctors, p. 41)

The active transfer mechansim can be split into two techniques: the push and the pull technique. The push technique focuses on the availability of specific technologies which are channeled to groups and organizations in response to perceived needs or in anticipation that new markets could be created for these technologies. This technique has not been too successful because the perceived needs often do not exist, or because new markets do not emerge once these technologies become available. Urban information and technology transfer networks employ the pull technique. Problems and needs are first identified and defined. Then, technologies having potential applicability to these needs are actively sought. A major problem associated with this technique, however, is the question of how to go about locating appropriate technologies.

Replication

Once a technology solution to a problem common to many local governments has been found and proven to be successful in one location, the solution can be "packaged" and a successful application of the package can be tried in another location. This process is called replication. (Batelle, 1977) Three phases are essential to the replication process:

(1) A technology solution has to be proven successful in one loction.

(2) The experience in this location has to be carefully documented and evaluated. Specific characteristics of the location, the technology application and the benefits accruing from the technology utilization have to be documented. A "package" has to be developed which gives detailed information and instructions on how to approach the problem with the particular technology solution.

(3) Other locations with similar problems, showing the same or similar characteristics as the first site, have to be selected. The previously successful solution will then be applied.

Next to technology transfer, replication is the most important aspect of urban information and technology transfer networks. Substantial cost savings and cost avoidance can be realized.

Market Aggregation

Market aggregation, as one aspect of transfer networks, refers to the situation where local jurisdictions being grouped together through a certain network operation form a market. Private industry can serve the network market much better than individual local governments because:

(1) the networks usually try to group local jurisdicions so that a high commonality in their problems is achieved;

(2) the networks assist in the definition of local problems.

(3) the needs of local governments participating in a network are assessed and priorities assigned; and

(4) the networks often help private industry, which invests in research and development to produce new technology solutions to local government problems, to market their products.

Market aggregation can be a good incentive for private industry to invest in local government oriented research and development activities, a field which until recently did not receive much attention. The market was too fragmented to justify research and development investment of any effective magnitude. The degree of market aggregation which can be achieved by a network is directly related to the degree of problem commonality among local governments which participate in the network.

Cooperative Research

Since transfer networks link local governments with appropriate agencies at the federal level, private industry, universitities, and research and development institutions, they provide exceptional opportunities for cooperative research efforts. Cooperative research refers to the combination of parties involved in a research project. It may take various forms depending on the structure of the network involved. The most common approach to cooperative research can be found in the "lead jurisdiction" concept. The network's central office arranges for a research effort to be undertaken by a local jurisdiction, together with appropriate research and development support from other groups. Under this arrangement the lead jurisdiction will develop a technology solution to a problem common to several other jurisdictions in the network. After successful completion of such a cooperative research project, replication is the process used to disseminate the results and convince other jurisdiction to utilize the technology innovation.

Influence on Future R&D Policy

Networks provide a great opportunity to influence future research and development policies of private and public agencies and institutions. Local governments can jointly define their problems and assess their needs. They can

present prioritized lists of their needs indicating the number of local governments in this country facing similar problems.

The role of the networks' central offices can take different forms. Some of them might directly take their problems to the federal level, discussing them with federal mission agencies, securing funds for demonstration projects, or channeling their demands to appropriate legislative committees. Others might approach national public interest groups which represent local governments to have them take appropriate steps to influence future research and development policies in the local government sector.

Typology

To facilitate future comparison among operational urban information and technology transfer networks and their classification, a typology of such networks will be developed. The typology will cover the general network characteristics: (1) user, (2) services, (3) operation.

Typology	Explanation/Discussion
(1) User -USER TYPE: • Local Governments -County -City • State Governments	USER TYPE indicates the type of user being served by the network

Typology	Explanation/Discussion
-USER CHARACTERISTICS: • Population Size • Economic Base • Growth Rate • Per Capita Income • Density • Form of Government • Other • None Specific	USER CHARACTERISTICS describes the network user by specific criteria. The only criterion which is currently being used to group users is the population size of the user's jurisdiction.[1] Yet, using a set of characteristics to describe the network users could insure an increased resemblence and commonality of the users' problems which the network is trying to help solve.
-USER STATUS: • Member • Client	Most of the information and technology transfer networks operate on a membership basis. This insures continuity in the networks' activities, fosters greater participation of the users/members, and stimulates long-term research and development efforts, experiments and faster exchange of individual experience.
-NETWORK COVERAGE: • Sub-State Region • State • Supra-State Region • Nation	Commonly networks operate on a national or state basis. Other entities such as the supra-state and sub-state regions are less feasible due to increased difficulties and problems in inter-institutional communication and cooperation.
(2) Services	
-TECHNOLOGY TYPES • Hardware-Oriented • Software-Oriented	Most networks provide a mix of technology types. Hardware technology addresses the needs of public works or fire departments. Software technology is geared more toward the managerial and administrative needs of local governments.

[1] The PTI-related networks, the Urban Consortium, the Urban Technology System and the Community Technology Initiatives Program, are using the population size as a membership criterion.

Typology	Explanation/Discussion
-ACTIVITY TYPES: • Problem Identification • Technical Information • Technical Assistance • Demonstration Program • Marketing Assistance	Most networks cover three activity types: problem identification, providing technical information and technical assistance. A demonstration program directed toward selecting one or more user jurisdictions and testing there a given concept or technology. If the results of the experiment and tests are encouraging and promising, the technology and experience of implementing and using it will be "packaged" and transfered to other jurisdictions participating in the network. Marketing assistance is provided in some cases to private industries servicing the public sector by the network. Test sites for demonstration programs are selected and information on the particular industry's services and goods is disseminated among the network users.
(3) Operation	
-NETWORK ADMINISTRATION TYPES • Public - Government - University • Non-Profit	Most information and technology transfer networks are either run as a public or non-profit operation. Non-profit organizations maintain a more or less independent position between private industry and government interests. This can ensure better working conditions for the non-profit network operation in terms of public and private sector acceptance.
-GUIDANCE: • University • State Government • Local Government • Private Industry	Guidance to the networks' program offices is provided in most cases through advisory bodies, usually consisting of representatives of various public and/or private groups.

Typology	Explanation/Discussion
-LINKAGE TYPES: • Network-User -Local Resident -Technology Agent (TA) -District TA/ Extension Agent -Local Government Representative • User-R&D Back-up Sites -Direct Link(through TA) -Indirect Link(through Central Office)	This criterion defines an information and technology transfer network in in the most distinctive way. The linkage type a network employs exhibits the character of the network. The linkages can be split into two categories; the linkage between the network and the user, and the linkage between the user and a research and development back-up site. The R&D back-up site has to be able to draw from an extensive amount of information and experience to respond to local government requests for technical assistance.
-TRANSFER PROCESS TYPES: • Push-Process • Pull-Process	Push- and Pull-Process in technology transfer are distinguished by the role of the technology user in the process. If a user actively requests a solution of a problem and the network operation reacts accordingly then on calls that a pull-process. However, if a technology is available for the solution of a problem and the network operation tries to have users apply this particular technology, this is a push-process.

CHAPTER III

OPERATION OF URBAN INFORMATION AND TECHNOLOGY TRANSFER NETWORKS

Description of Operational Networks

The five operational networks introduced in this chapter differ in their objectives, size, structure and operation. The networks are selected so that the various characteristics of information and technology transfer networks which are desirable, occur at least once in this overview. Yet, the overview is not comprehensive. Recently established transfer networks such as the Community Technology Initiatives Program and the Pacific Northwest Innovation Group are not covered because not enough data is available.

Urban Consortium for Technology Initiatives

Function. The Urban Consortium (UC) was established in 1974. It operates as a forum in which the nation's 28 largest cities and six urban counties with a population above 500,000 meet to define their needs, select high priority needs for research and development, encourage the exchange of information and technologies, and direct targeted research efforts at the federal level. Public Technology, Inc. (PTI) serves as the secretariat for the Consortium.

PTI is a nonprofit, public interest organization that serves the governmental needs of cities, counties, and states. PTI uses new technology to:

-Improve the delivery of public services,

-Reduce service delivery costs,

-Avoid future service cost increases.

PTI has found that the most effective way to achieve these ends is to take advantage of new technology in the solution of management and operational

problems facing local and state governments across the country. PTI focuses on research and development in areas identified by local and state governments and involves federal agencies, foundations, and private industry in financing new systems and products for public sector use.

The Urban Consortium's broad objectives are: (1) to develop an effective mechanism for linking the nation's major urban jurisdictions in an effort to apply science and technology in planning and program execution; and, (2) to establish inter-institutional arrangements to improve the delivery and implementation of science and technology applications to meet urban needs.

Work Program. The Consortium's work program involves building an agenda of problem statements, establishing research and development priorities, participating in cooperative research and development, facilitating demonstrations and proof-of-concept testing, improving the information flow among participating governments, stimulating market aggregation for the application of developed solutions, and building new institutional working relationships.

Organization. The structure of the Urban Consortium has evolved in a way to insure flexibility for future tasks. Each of the 34 local governments appointed an official delegate to serve as its permanent Consortium representative. Delegates report directly to either the chief executive officer or to the chief elected official of their jurisdiction. While the full 34-member Consortium is responsible for general policy, day-to-day operation is assigned to the PTI secretariat under guidance of the Urban Consortium Steering Committee (Figure III-1.)

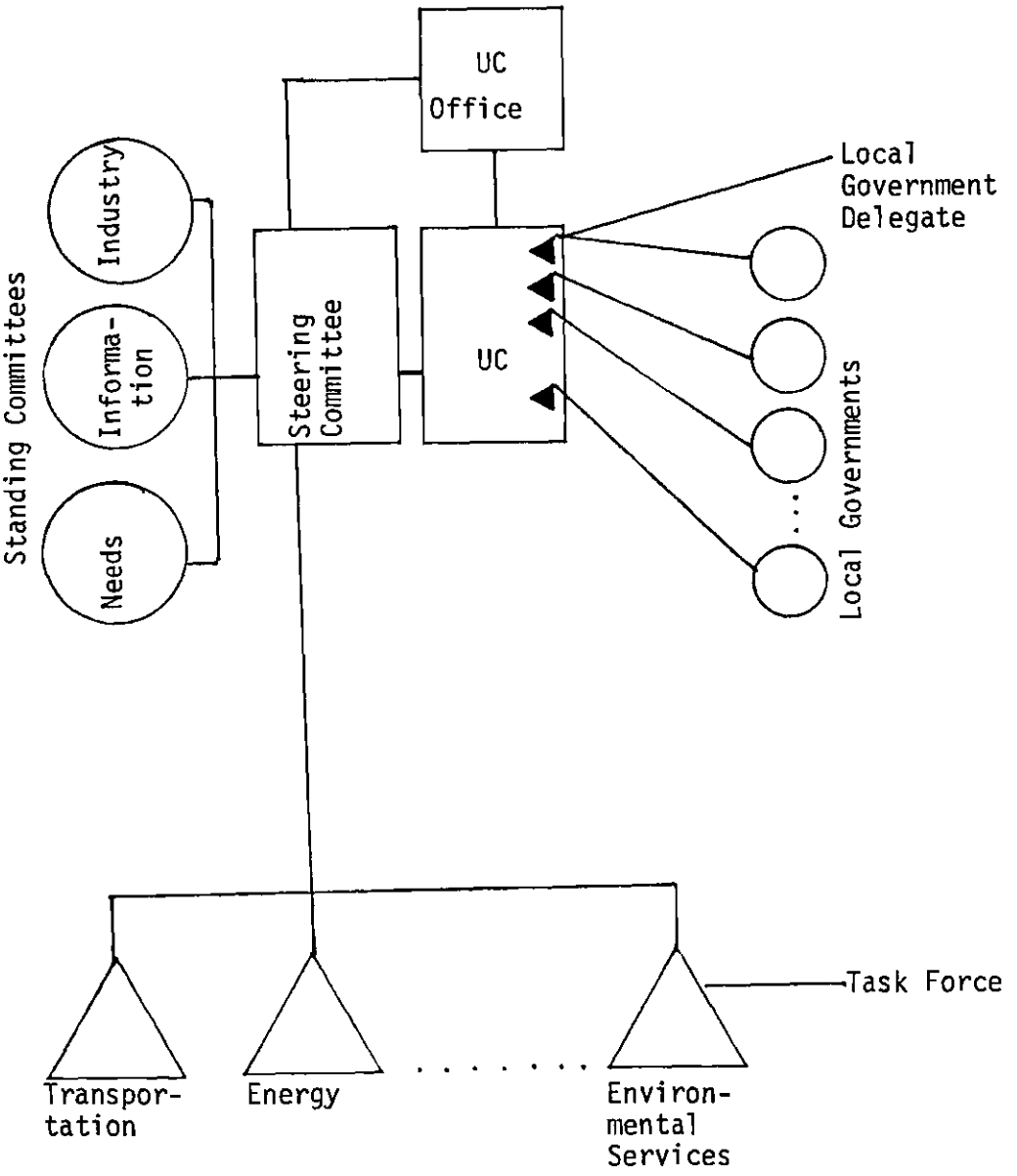

Figure III-1. Organizational Structure of the Urban Consortium for Technology Initiatives

The Consortium's 11 member Steering Committee is elected from among the member jurisdictions. Responsibilities of this Committee include organization and appointment of all Consortium committees and subcommittees, review of all agenda items prior to submittal to the full Consortium, and development of interim policy between meetings of the full Consortium. Following is a brief discussion of the standing UC-committees.

The Needs Committee oversees the comprehensive needs list of member jurisdictions. The needs list is divided into major categories such as transportation, energy, human resources, public works and public utilities, fire safety and disaster, community and economic development, and environmental services. Task Forces, one for each major need category identified in the list, were created based on recommendations of the Needs Committee. The Needs Committee revises and updates the needs list as necessary.

The Information Committee is responsible for continuing development of an information dissemination and exchange system. This system will inform member jurisdictions of significant technological developments. It will enhance the ability of members to communicate with one another on solutions to specific problems and to obtain information on other local governments' experiences in working toward solutions of priority needs.

The Commerce and Industry Relations Committee establishes and maintains a working partnership among commerce and industry, labor, and urban governments for the purpose of undertaking joint research, development and demonstration of potential solutions to urban problems.

The technical work of the Consortium is performed through the Task Forces. The Task Forces recommend projects to the full Consortium. After approval, each project is guided by a User Design Committee (UDC) which is

dissolved again after project completion. The UDCs, composed of specialists from both the private and governmental sectors, establish detailed technical requirements for the product or method to be developed, and participate throughout each project to ensure that the results are of practical value to member jurisdictions.

The Task Forces are structured to encourage interaction among private industry, Federal government, and the UC-member jurisdictions. Each Task Force is composed of city and/or county representatives and may also include Federal officials and representatives from industry. Member jurisdictions become members of those Task Forces on which they prefer to be active. The Task Forces play a key role in selecting the highest-priority needs for research and development efforts. Selections can include both projects requiring new research and those involving transfer of technology from existing applications.

Staffing. Since PTI assumes the role of a secretariat for the Consortium it is difficult to determine the exact number of staff members. Currently, a full-time principal investigator, director, and secretarial staff are associated with the Urban Consortium program. A twelve-member professional staff and a 7-member secretarial staff assist the director.

Financing. The Urban Consortium activities are partially funded by the National Science Foundation. From 1974 to 1977, $576,000 were allocated for the Urban Consortium program. Other sources of income are contracts with federal agencies, such as the Environmental Protection Agency, Department of Housing and Urban Development, Department of Transportation, Department of Energy, and the Department of Commerce.

Urban Technology System

Function. The Urban Technology System (UTS) was established in 1973. UTS consists of a network of 27 local governmetns throughout the United States with a population ranging from 50,000 - 500,000. UTS was organized to test an integrated technology delivery system on a broad geographic scale. The governing assumption underlying UTS is that a major problem confronting local officials is the need to analyze technical problems and apprise decision-makers of technical information and options in an organized and manageable way. The intent of UTS is to stimulate accelerated technological innovation, market aggregation, and research and development investment by:

(1) clearing and increasing communication channels among the system's components;

(2) developing more awareness of technological opportunities, needs, and capabilities;

(3) promoting education, training, and related policies and programs for increasing knowledge of applicable opportunities; and

(4) promoting an understanding of market aggregation possibilities.

Innovative application of technology within the UTS network usually consists of a combination of:

(1) research utilization, derived from federal government and industrial research projects; and

(2) direct transfer of successful innovations between cities and counties, a process called relication.

Work Program. The UTS network will establish relationships and procedures for communicating with other institutions and groups that transfer technology. It continues to encourage private sector investment in research and

development that is directed toward the non-federal public sector.

A new feature, the User Needs Group (UNG), will be formed to help set local government research and development priorities that can be matched to the efforts of industry and Federal government. UTS is also planning to institute an information transfer service involving the development of several types of data bases, the development and dissemination of various new publications.

Organization. The network consists of 27 participating communities, technology agents, research and development back-up organizations, and Public Technology, Inc. (Figure III-2). The participants are:

(1) City and County Governments: The 27 governments were randomly chosen by a computer from a list of all cities and counties with a 1970 population of between 50,000 and 500,000. Three factors were considered in the selection process: Geographical location, population size, and level of economic activity, as determined by federal revenue-sharing payments.

(2) Technology Agents: Technology agents, usually having a bachelor's degree in science, engineering, or computer sciences, a master's degree in business or public administration and an average of ten years' experience with technological products or processes, were placed on the staff of the participating local governments. The agents operate at the top decision levels usually as assistant city manager, in their jurisdictions. They promote local technological innovation and help to solve local government problems on a day-to-day basis.

(3) R&D Organizations: The more than 15 organizations chosen to back-ip the network had to meet a number of requirements. The requirements include the ability to identify the technology needed to solve urban

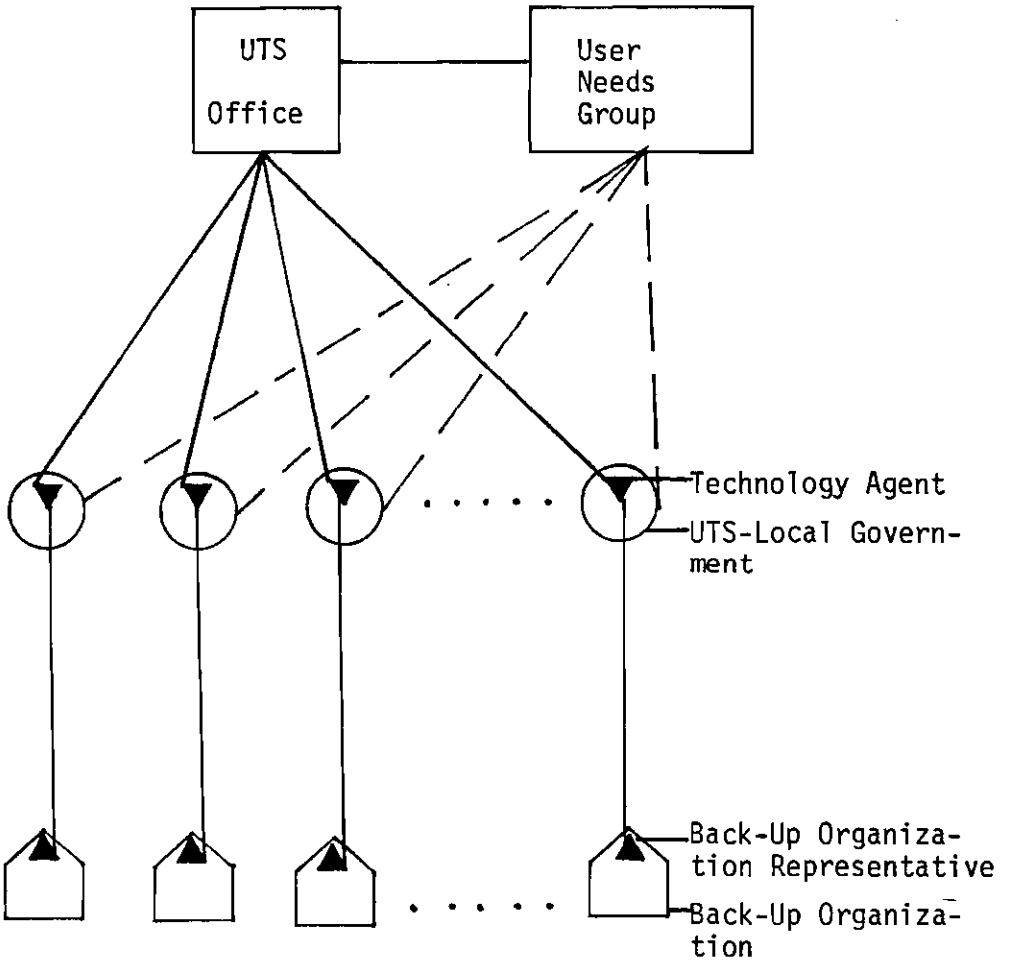

Figure III-2. Organizational Structure of the Urban Technology System

problems, a staff of at least 100 professionals, broad skills in science and engineering, an environment conducive to innovation, a primary group committed to spending at least 5 percent of its time on UTS problems, and prior interest in solving urban problems. Various types of back-up organizations are used: Federal laboratories, nonprofit institutes, industrial research and development groups and universities.

(4) Public Technology, Inc.: PTI assumes the role of a secretariat for UTS. (for details on PTI see page 19)

Staffing. Currently, a full-time principal investigator, a UTS director and secretarial staff are associated with the UTS network. As in the case of the Urban Consortium, PTI's technical staff support occurs on a project basis. For the first two years, the technology agents were on PTI's payroll, with 90 percent of their salaries paid by PTI through the National Science Foundation and 10 percent paid by their local governments. In the third year, the agent moved to the local payrolls with PTI paying 20 percent of their salaries for work related to the experimental aspects of the UTS network.

Financing. The UTS network is funded by the National Science Foundation. From 1973 to 1977 a total of $4.5 million were spent.

Center for Local Government Technology (Oklahoma Innovation Group)

Function. The Center for Local Government Technology (CLGT) is a multidisciplinary, university-based center, specifically designed as a technology delivery system to meet the needs of local governments in Oklahoma. Objectives are to assist local governments in improving the level, quality, and delivery of public services and to provide technical information and training.

Work Program. During the two initial phases of CLGT's work program significant problems of commod concern to local governments in Oklahoma were

identified, solution packages to allow an efficient transfer from one jurisdiction to another were developed, and the effectiveness of the information and technology delivery system and methods were validated. Currently, the Center is assisting land grant universitities in three states to create similar centers by providing them with the necessary know-how, and solution packages which have proven to be useful. In addition, the Center is developing, with 15 other universities engaged in providing technical assistance, a network to exchange, adapt, and disseminate solutions on a regional and national basis.

Organization. The Center for Local Government Technology has adapted U. S. Department of Agriculture transfer-dissemination mechanisms to non-agricultural engineering and management needs, particularly the on-site demonstration and extension agent concepts.

The Center's Research and Development Division develops solutions in concert with a test community. Once validated, the Extension Activities Division disseminates, on an area or statewide basis, information on the solutions using a large variety of methods, with emphasis on "on-site" demonstration and "start-up" assistance. (Figure III-3)

A User Steering Committee meets quarterly with the Center's management to evaluate the project selection, solution development, and dissemination efforts. The Committee consists of local government representatives, state legislators, and representatives of the Oklahoma Municipal League and the State Office of Community Affairs and Planning.

A University Advisory Committee ensures professional and academic advice and guidance from eleven different departments within the university through one representative from each department.

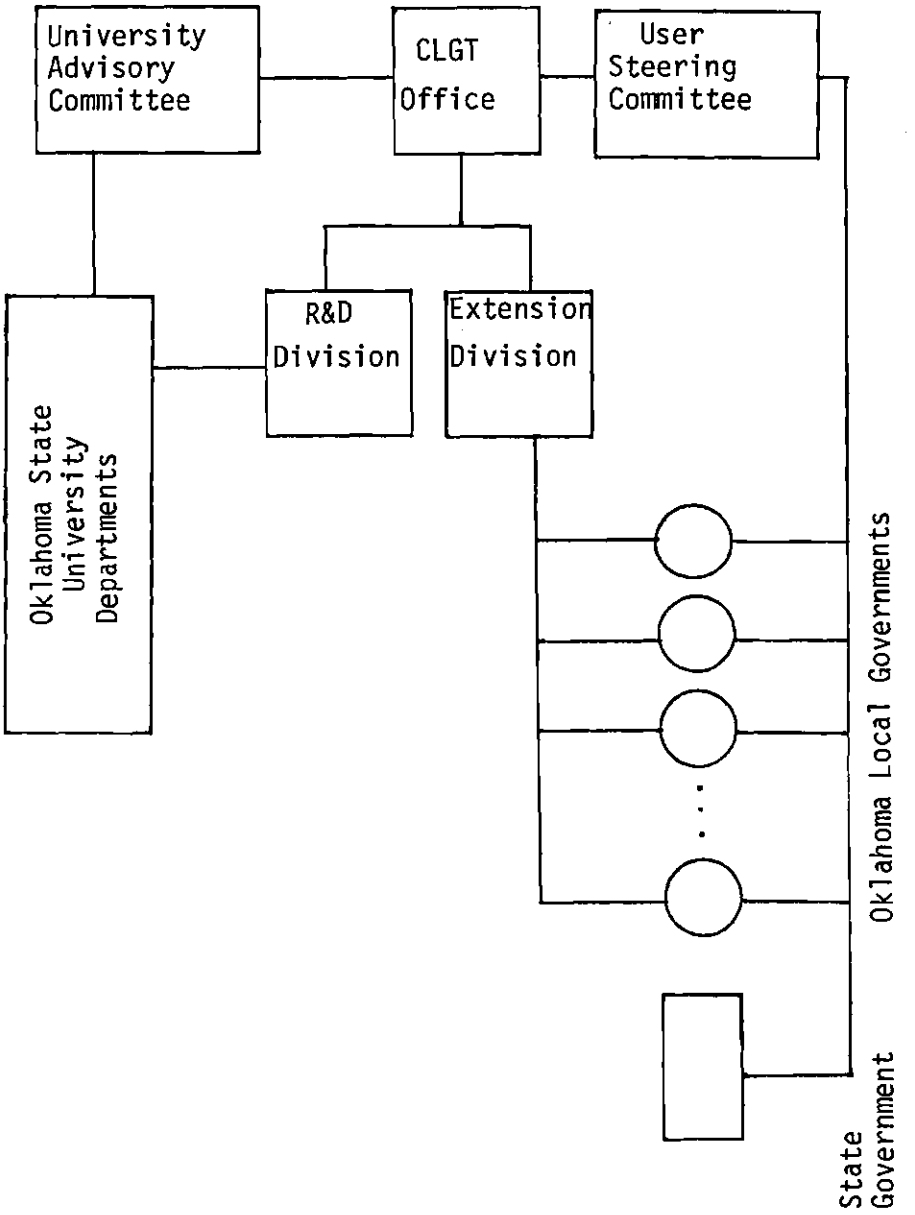

Figure III-3. Organizational Structure of the Oklahoma Innovation Group, Center for Local Government Technology

Staffing. The Extension Activities Division is currently headed by an engineer asssited by a technical information specialist, a mechanical engineering specialist, civil engineering specialist, and a secretary. The Research and Development Division is headed by the director of the Center. Since his division relies solely on the university staff, faculty, and student resources for research and development project activities in the local government field, an accurate number of staff members cannot be provided.

Financing. From 1972 to 1977 the National Science Foundation has funded the Center for Local Government Technology with $731,000.

Georgia Innovation Group

Function. The Georgia Innovation Group (GIG) was created by the State of Georgia to develop methods for systematically identifying and solving short-term and longer-range problems facing local governments through the application of state government and university resources. The Georgia Innovation Group has five specific objectives:

(1) to design a system for identifying problems facing local governments;

(2) to test mechanisms involving a coalition of state and university resources for solving identified problems;

(3) to strengthen the cooperation between state agencies and universities;

(4) to encourage replication of successful technology applications at the local government level; and

(5) to achieve insitutionalization of the GIG approach within three to four years.

Work Program. Currently the Group is working on two studies: Reducing Municipal Vandalism and Neighborhood Data Collection to comply with HUD Application Requirements. Funding has been approved for studies in three

additional problem areas: Maximizing Revenues and Minimizing Expenditures, Local Government Management, and Assessment of Needs for Water and Sewer Treatment Plants. The Group has developed an ongoing needs assessment process and a university resource directory is currently being compiled.

Organization. The Georgia Innovation Group consists of an Inter-University Task Force and a Local Government Advisory Committee (Figure III-4). The Task Force consists of representatives of the Georgia Department of Community Affairs, which is assuming the lead, and representatives of three universities including the United States Department of Agriculture Cooperative Extension Service. Representatives from the Georgia Municipal Association and the Association of County Commissioners of Georgia play an advisory role on the Task Force. It meets on a monthly basis.

The Local Government Advisory Committee is comprised of six mayors, six city managers, one county commissioner, and one county manager. The Committee meets on a quarterly basis to provide the Task Force with direction and guidance by both submitting requests and approving proposals. The Committee selects high-priority projects from a list of requests for assistance by local governments. The list is based on requests received by the universities based on local governments' needs surveys previously performed.

Staffing. The Georgia Innovation Group is headed by a project director employed by the Georgia Department of Community Affairs. Various professionals from the Department are used to work on specific projects. The Georgia Municipal Association and the Association of County Commissioners of Georgia also provide staff assistance to certain projects. Ongoing support is also received from the three participating universities. Secretarial support is provided by the Department of Community Affairs.

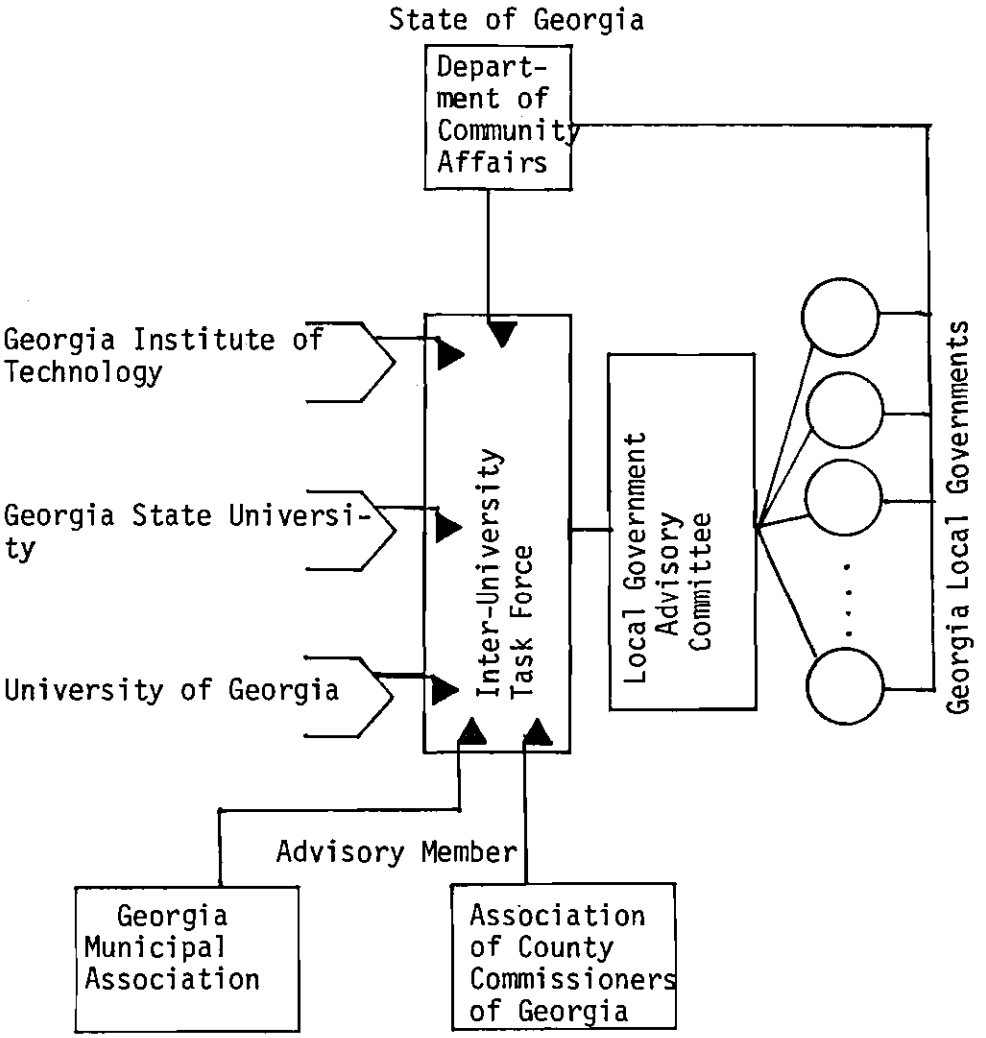

Figure III-4. Organizational Structure of the Georgia Innovation Group/Inter-University Task Force

Financing. To date $170,000 have been alloted by the National Science Foundation for the Georgia Innovation Group.

California Innovation Group

Function. The California Innovation Group (CIG) is a statewide consortium of eleven incorporated cities, one county and League of California Cities. Its basic objectives are to:

(1) use a team approach to select urban problems and to demonstrate this approach in solving science and technology utilization problems,

(2) establish a statewide utilization-transfer system comprised of cities, science advisors, industry and the League of California Cities and a statewide communications network,

(3) develop additional resources for supporting urban technology development and utilization in terms of funding and personnel in state and Federal agencies, the universities, nonprofit institutions and industry, and

(4) develop a structural organization and operating mechanism to facilitate direct technical assistance to an expanded clientele.

Work Program. CIG's work program is divided into three components: technology analysis, technology utilization, and information dissemination. All three components are equally emphasized byCIG's program office and the individual technology agents in participating jurisdictions. Special projects which CIG primarily deals with fall into two categories; (1) product development and test-of- concept, and (2) evaluation and testing of existing products.

Organization. Established as a nonprofit California corporation, CIG's policy direction and program priorities are set by an Advisory Board consisting of 9 participating managers and a Board of Trustees. Day-to-day program management and coordination is provided by the CIG President.(Figure III-5)

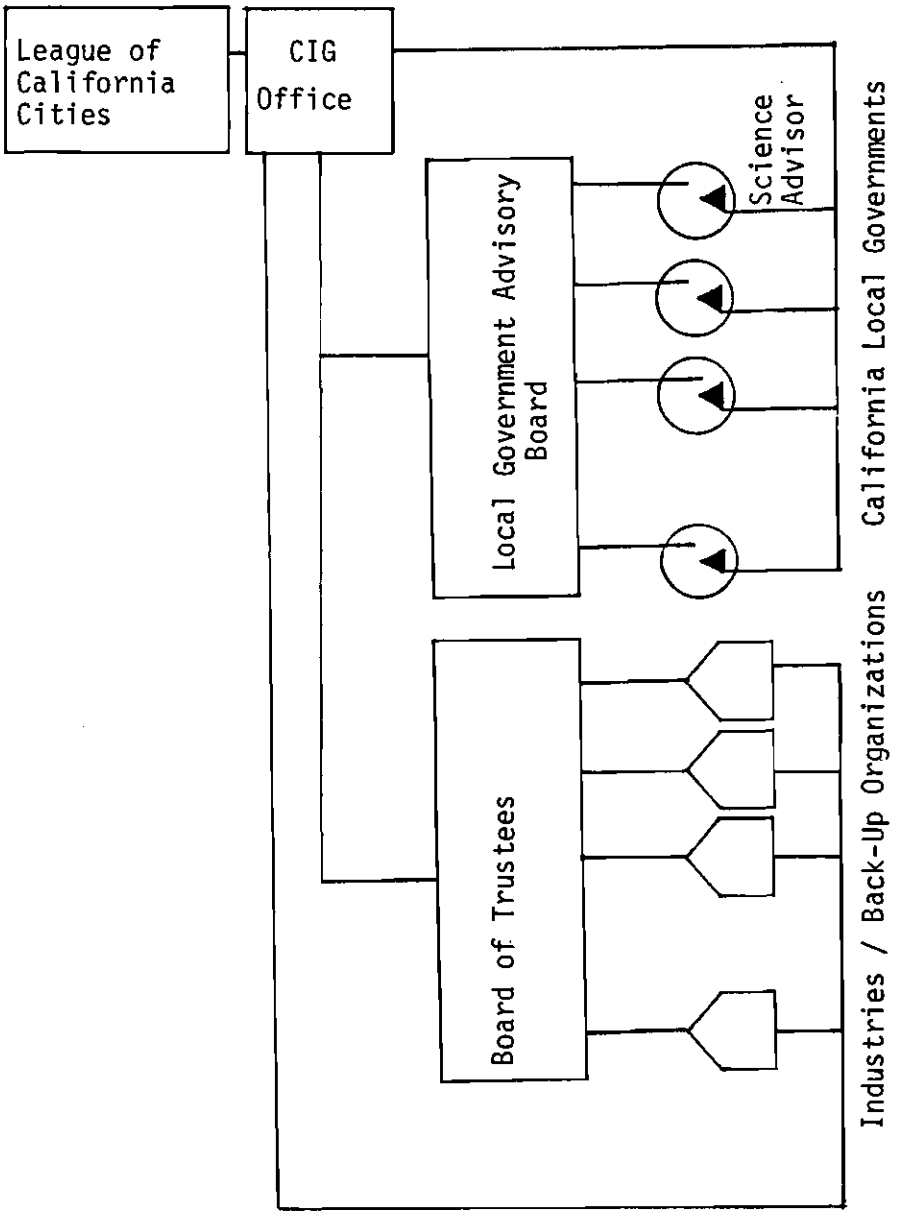

Figure III-5. Organizational Structure of the California Innovation Group

CIG relies on a team of participants serving municipal governments, from both the public and private sectors. This team consists of local governments, high technology firms, universities, a full-time representative from the League of California Cities, and most important, the individual Technology Agents resident in each participating jurisdiction. Coupled with this team is the technical resource of the Federal Laboratory Consortium.

The Technology Agent is working for the city manager of the respective city he is assigned to. The agent spends 50 percent of his time working on projects that the CIG Advisory Board has identified as being of common importance to all members. The remaining 50 percent is spent on projects assigned by the city manager.

CIG operations frequently employ the "lead jurisdiction" concept for joint operations, in which case the lead jurisdiction's Technology Agent is designated as project manager. Individual project management is guided by the respective city manager. The dissemination of information on successful projects is handled by field representatives of the League of California Cities.

Staffing. A director, technology transfer coordinator, and a secretary make up the staff of the California Innovation Group.

Financing. Since 1974, CIG has received funding primarily from the National Science Foundation. From 1974 to 1977, NSF allocated $945,000 for CIG's activities.

Comparative Overview of Operational Networks

Applying the typology developed in Chapter II to the networks described above one can easily classify these networks and depict major differences among them. It also becomes obvious that certain network characteristics listed in the

typology do not occur in the operational networks.

Typology Items \ Network	URBAN CONSORTIUM	URBAN TECHNOLOGY SYSTEM	Center for Local Government Technology	GEORGIA INNOVATION GROUP	CALIFORNIA INNOVATION GROUP
(1) User					
-USER TYPE:					
• Local Governments					
-County	x	x	x	x	x
-City	x	x	x	x	x
• State Governments					
-USER CHARACTERISTICS:					
• Population Size	x	x			
• Economic Base					
• Growth Rate					
• Per Capita Income					
• Density					
• Form of Government					
• Other					
• None Specific			x	x	x
-USER STATUS:					
• Member	x	x			x
• Client			x	x	
-NETWORK COVERAGE:					
• Sub-State Region					
• State			x	x	x
• Supra-State Region					
• Nation	x	x			
(2) Services					
-TECHNOLOGY TYPES					
• Hardware-Oriented	x	x			x
• Software-Oriented	x	x	x	x	x

Figure III-6. Comparative Overview of Operational Networks

Typology Items \ Network	URBAN CONSORTIUM	URBAN TECHNOLOGY SYSTEM	Center for Local Government Technology	GEORGIA INNOVATION GROUP	CALIFORNIA INNOVATION GROUP	
-ACTIVITY TYPES:						
•Problem Identification	x	x	x	x	x	
•Technical Information	x	x	x	x	x	
•Technical Assistance	x	x	x	x	x	
•Demonstration Program	x	x	x		x	
•Marketing Assistance	x	x				
(3) Operation						
-NETWORK ADMINISTRATION TYPES						
•Public						
-Government				x		
-University			x			
•Non-Profit	x	x			x	
-GUIDANCE:						
•University			x	x		
•State Government			x	x		
•Local Government	x	x	x	x	x	
•Private Industry	x				x	
-LINKAGE TYPES:						
•Network-User						
-Local Resident -Technology Agent (TA)		x			x	
-District TA/ Extension Agent			x	x		
-Local Government Representative	x					

Figure III-6. Comparative Overview of Operational Networks

Typology / Network Items	URBAN CONSORTIUM	URBAN TECHNOLOGY SYSTEM	Center for Local Government Technology	GEORGIA INNOVATION GROUP	CALIFORNIA INNOVATION GROUP	
• User-R&D Back-up Sites						
–Direct Link(through TA)		x	x		x	
–Indirect Link(through Central Office)	x	x	x	x	x	
–TRANSFER PROCESS TYPES:						
• Push-Process						
• Pull-Process	x	x	x	x	x	

Figure III-6. Comparative Overview of Operational Networks

The most important aspect of information and technology transfer networks is the linkage type. Experts in the field of technology transfer strongly emphasize the role of a technology agent. The technology agent, between the technology supplier and its user, is responsible for marketing innovations, for introducing change, and solving the technology user's problems. The agent is a broker, middleman, and central figure in the transfer process. In the following, the internal linkage types employed by the various networks are analyzed.

UC - Organization

The individual local government nominates an urban consortium representative. The representative represents the local government in committee and task force meetings. He solicits the opinions and the needs of the functional departments in his jurisdiction. The UC representative is a broker, an information carrier, but not necessarily a problem solver. He only assists in getting a problem in the urban technology field solved. The UC is based on a local government membership.

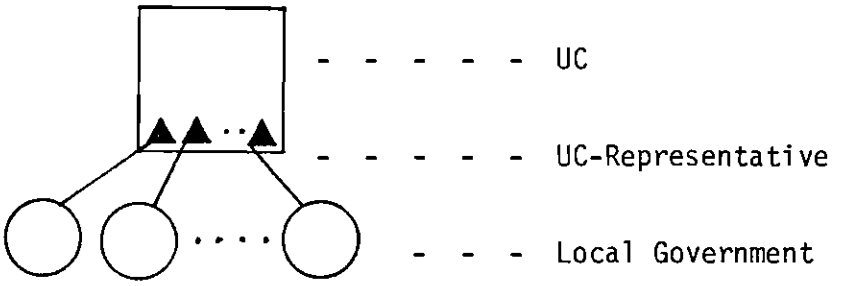

Figure III-7. Urban Consortium - Linkage Type

UTS - Organization

The technology agent was hired by UTS and assigned to participating individual local governments in UTS. The agent connects the UTS, local government, and back-up site. He is the vital link in technology transfer and performs an active role in problem-solving with the support of the back-up site.

UTS is based on a local government membership.

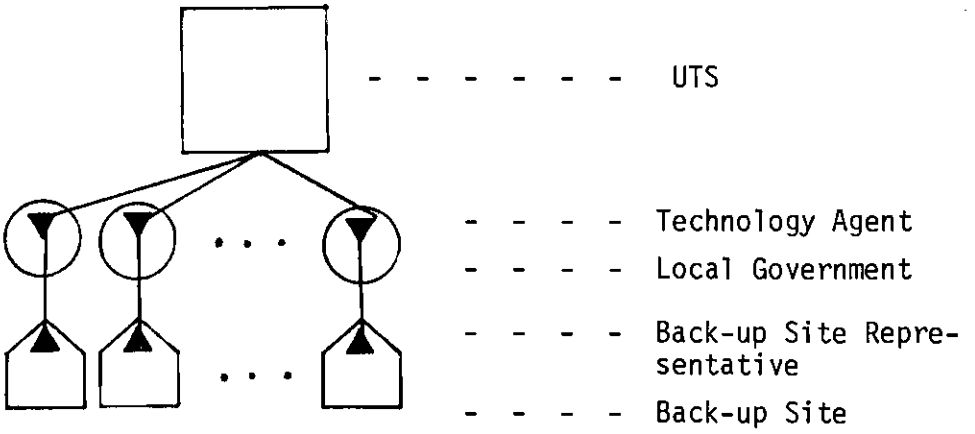

Figure III-8. Urban Technology System - Linkage Type

CLGT - Organization

The extension agent receives requests for assistance from local governments. The agent is not permanently assigned to a local government. The agent is only involved with a certain government on a project or problem basis. CLGT is not based on a membership. Services are available to all local governments in Oklahoma.

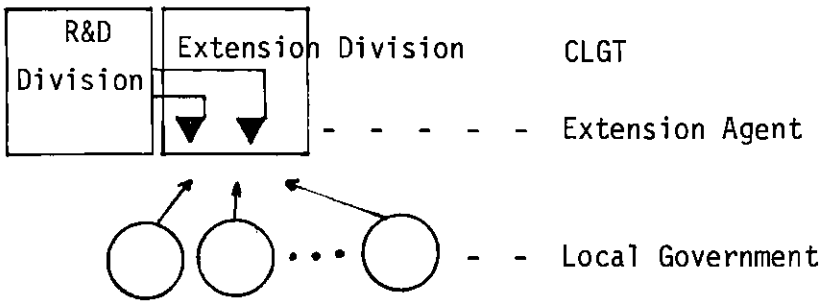

Figure III-9. Center for Local Government Technology - Linkage Type

GIG/IUTF - Organization

There is no technology agent concept employed. Linkage between local governments and the IUTF occurs through the Georgia Department of Community Affairs or directly through the participating universities. GIG/IUTF is not based on a membership, and services are available to all Georgia local governments.

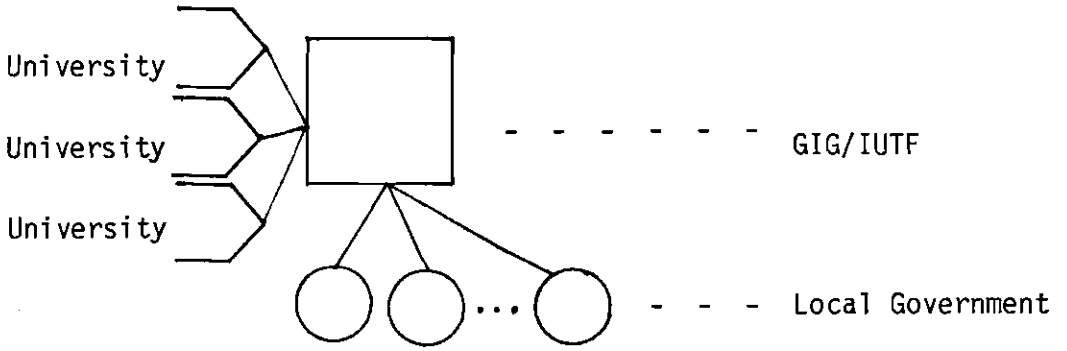

Figure III-10. Georgia Innovation Group/IUTF - Linkage Type

CIG - Organization

CIG's internal linkage type is similar to the UTS type. A technology agent is placed into each city hall providing ad-hoc assistance in day-to-day problem solving and participating in long-term multi-city research and development projects. CIG is based on a membership.

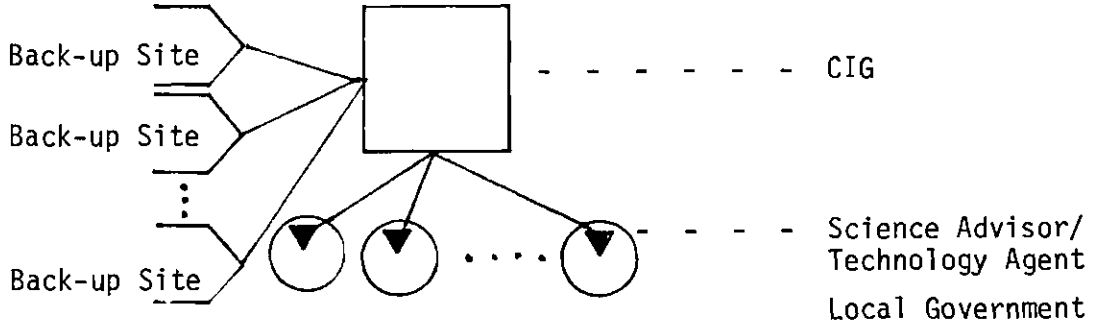

Figure III-11. California Innovation Group - Linkage Type

Figure III-12 shows the external linkages of the five networks. The relationships to other information and technology transfer programs, innovation projects, and public and private research and development organizations are indicated.

Organizations \ Networks	UC	UTS	CLGT	GIG	CIG	
Federal Government:						
HUD	x				x	
EPA	x					
DOC	x					
DOE		x			x	
DOT	x					
NASA	x				x	
NSF	x	x	x	x	x	
Federal Laboratories	x				x	
USCM	x					
ICMA	x	x				
Other Public Interest Groups (Nation)	x	x	x			
State Government Agencies			x	x	x	
Public Interest Groups (State)			x	x	x	
University Public Service and Research Association			x	x		
International Urban Technology Exchange Program	x				x	
Private Industry, BUS		x			x	
University, BUS			x	x	x	
Other Professional Associations and Societies	x	x	x	x	x	
UC	-			x	x	
UTS		-		x	x	
CLGT		x	-	x		
GIG		x	x	-		
CIG	x	x			-	

Figure III-12. External Linkages of Five Operational Networks

CHAPTER IV

CRITIQUE OF OPERATIONAL NETWORKS

Approach

In the previous chapter five operational urban information and technology transfer networks were introduced. The networks differ from each other in varying degrees as can be seen in the comparative overview. They not only operate according to slightly different goals and objectives but they also use different methods and procedures of operation, provide different kinds of services to their users, and serve different geographic areas and different types of local jurisdictions.

The Urban Consortium, consisting of some of the largest U.S. cities, puts strong emphasis on trying to influence the federal long-range research and development agenda to address more of local government problems. The Urban Consortium constitutes a great political leverage and has considerable clout. The technology agent concept, employed by the Urban Technology System, would not work in the context of the Urban Consortium. The technology agent would have to consider too many political aspects of big city government. The agent's work could not be effectively performed under such circumstances. The Urban Consortium's structure and operation is based on the assumption that, to solve local problems through technological innovation the top elected and appointed officials of major local governments have to participate actively in the effort. In fact, they have to control the technology network (Urban Consortium), its policies and its priorities.

The Urban Technology System, on the other hand, places its emphasis on the technology agent concept. UTS's major thrust is toward providing technological assistance at the local level on a day-to-day basis. Influencing long-range research and development activities in the public sector also plays an important role. Only recently has UTS established a local government advisory group to actively assign priorities to local government long-range needs and to find research and development organizations which will address those needs. UTS serves local governments with a population size ranging from 50,000 to 500,000. These cut-off points were selected arbitrarily but it was felt that the lower limit ensured that cities would be able to support the technology agent concept financially and that the upper limit prevented the concept from becoming ineffective through major cities' politics.

The Center for Local Government Technology at the Oklahoma State University is serving predominantly rural communities. The communities are mostly too small to support a technology agent and, since Oklahoma has been and is an agriculture-oriented state, people and their governments are familiar with and trust the Extension Service concept. They know where to turn to for advice in agriculture and what to expect. By employing an Extension Service concept, the Center for Local Government Technology makes full use of the successful past experiences and concepts in the field of agriculture. Like the Urban Technology System, the Center provides day-to-day technical assistance to local governments upon request.

The Georgia Innovation Group/Inter-University Task Force, a state run operation, balances long-range academic research and short-term consulting in its activities to assist local governments. Through day-to-day interaction and cooperation with local governments the GIG tries to solve technology-related

problems on an ad-hoc basis.

The California Innovation Group, which shows most of the features of the national Urban Technology System, employs a technology agent concept and provides advice and help to local jursidiction on an on-going basis. The CIG also cooperates effectively with a public interest group, the California League of Cities, for information dissemination purposes.

Overall, one can easily see that a critique of these five networks using one set of performance criteria is impossible.[1] The networks are too different to apply an absolute standard for evaluation and critique. Thus, it can not be the purpose of the critique to select one network over another one as being better, more efficient and more effective. All the networks described are performing their tasks adequately and meet their goals.

The purpose of the critique, however, is to point out difficulties and deficiencies in the various networks by relating them either to conceptual aspects or to typology items as discussed in Chapter II. The critique is based on personal interviews and special network reports. Details can be found in Appendix 1. Three restrictions will be observed:

(1) The critique will be at a macro-level of network operation or structure.

(2) Only criticisms which could lead to substantial change in the structure or operation of a network will be listed.

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[1] A cost/benefit analysis could rank the financial effectiveness of the five ventures by assigning a ratio of overall realized savings and cost avoidance to overall operation cost of each of them. Problems associated with cost/benefit analyses of urban information and technology networks are:
(1) How to measure some of the achievements?
(2) How long do the networks have to operate before they should be analyzed?
Appropriate cost and savings data is only available for the California Innovation Group and the Urban Technology System.

(3) Criticisms of internal details of the network structure or operation will be included only if they could lead to a different interpretation of the networks' function and design.

Each point of criticism will be followed by a recommendation. The recommendations will be used in Chapter IV as design criteria for an alternative urban information and technology transfer system.

Concept-Related Critique

The critique will use the concept of networks described in Chapter II as a guiding structure. Barriers to technology utilization, technology transfer, replication, market aggregation, cooperative research, and future R & D policy in the operational networks will be discussed.

Barriers to Technology Utilization

Cost. Cost limitations are severe for all of the five operational networks. They all try to improve the situation by applying for grant money from federal mission agencies and other sources, to sponsor special projects and demonstration programs at the local level. Besides the difficulties in securing money for technology utilization projects at the local level, networks have to cope constantly with the problem of how to fund their own ongoing operations. Yet recent cost savings and cost avoidance due to increased technology utilization at the local government level, gives rise to optimism with respect to future funding of technology transfer and utilization by federal mission agencies and other sources.

Recommendation: Transfer networks should continue to prove their viability and effectiveness in saving cost or avoiding future expenses through technology utilization. The technology transfer networks should make better use

of national public interest groups and lobbies which have been serving local governments. They can exert more pressure on federal legislation and administration to increasingly address technology transfer and utilization questions in the public sector.

Political Environment. The five operational networks discussed above employ a pull technique for the technology transfer and utilization process. It is assumed that those local governments actively participating in and influencing the activities of the networks are progressive enough to explore the potentials of increased technology utilization.

Recommendation: In introducing the technology transfer and utilization concept and specific technology solutions, networks should rely heavily on demonstration projects. The lead jurisdiction concept has proven to be very effective in that context. They should also try to reach and educate local decision makers through their peers, the public interest groups representing them, and their jurisdictions.

Awareness and Attitudes. Urban information and technology transfer networks have been operating only for a short period of time. During that time they have proven the validity of the premises under which they are operating. Yet a lot still has to be done to disseminate information on their general nature, potentials, and operation. Emphasis needs also to be placed on the demystification of technology.

Recommendation: Increased education of local officials and decision makers on the potentials and benefits of technology utilization in the public sector is necessary. Effective channels to do this could be the respective professional organizations and associations which are related to public sector professions.

Regulations. Creating change and introducing innovations is a lengthy

process. Only a continuous demonstration of the benefits of technology utilization at the local level can create the climate for a wide local acceptance of the concepts involved.

Recommendation: Networks should actively assist local governments in surmounting regulatory barriers to technology utilizations. Model codes, standards, purchasing policies, and innovation favoring bidding requirements should be developed and disseminated to local governments.

Technology Transfer

With respect to the cost- and time-saving aspect of technology transfer, data are available on two of the urban and technology transfer networks described earlier. The California Innovation Group in its Special Report documents overall cost savings per year of $3,139,300 compared to overall one-time implementation costs of $2,075,690. (CIG, 1977, p.9) The Urban Technology System in its Special Report shows a total actual return on investment (cumulative) of approximately $12.8 million on a total actual investment (cumulative) of approximately $9.5 million over the same period of time. (PTI, UTS, 1976, p. 6) The ratio of return to investment is expected to increase over the coming years. The Urban Consortium is planning a full-scale evaluation of its operation by the end of Fiscal Year 1978. No cost saving data are now available on the Center for Local Government Technology and the Georgia Innovation Group. Overall, it can be said that the technology transfer to the public sector has proven to be economically successful.

One problem the networks still have to resolve, in a more effective and efficient way, is associated with the transfer pull technique. Needs assessments call for a matching of appropriate technology solutions which have to be located or developed. Besides a needs list, a technology availability list would be highly

desirable.

Recommendation: An information and communication system should be developed which is centrally operated, constantly updated, and flexible enough to process technology availability data to match needs data. The system should be accessible through remote terminals in all network-participating jurisdictions.

Replication

The five networks employ the replication process to various degrees. Little replication of proven technology solutions among the networks has occured. Even less adaptation of some promising innovations has been accomplished outside the technology transfer networks. A research project being conducted by Battelle aims at developing and applying "a methodology which will accelerate the diffusion, adaptation, and adoption of proven innovations in local governments . . ." (Battelle, 1977, p.4)

Recommendation: Networks should emphasize the inner- and inter-network replication process. A process should be developed which will ensure that (1) sufficient information on proven innovations will be available, (2) appropriate information dissemination and "marketing" strategies will be used to announce innovations, and (3) a thorough search of the needs list of all jurisdictions will be performed. This process should improve the selection of potential sites for replications of user proven innovations.

Market Aggregation

All of the five networks incorporate the market aggregation aspect. The networks serve groups of local governments whose degree of problem commonality varies. A high market aggregation can only be achieved when a high problem commonality exists among network users, which can be insured by using user characteristics as criteria for network participation.

Recommendation: Networks should use more specific criteria to group network users and/or restrict participation.

Cooperative Research

All five networks use cooperative research to develop technology solutions. They employ the lead jurisdiction concept facilitating demonstration and proof-of-concept testing. The replication process is used to introduce the proven innovation in other jurisdictions.

Recommendation: None.

Influence on Future R & D Policy

The opportunity to effectively influence future R&D policy seems to be limited to national networks. The Urban Consortium has been quite successful in this endeavor.

Recommendation: Networks which operate at the national level should cooperate with public interest groups and their respective committees to influence the future R&D policies at the national level.

Typology-Related Critique

The critique will use the typology items developed in Chapter II as a guiding structure. Aspects relating to the network users, services, and operations will be discussed

User

All five urban information and technology transfer networks serve local governments. To ensure the most effective operation of the networks with respect to needs assessment, research and development, replication, and market aggregation the users should be grouped in a way that they resemble each other as much as possible.

User Types. In several networks participating county governments feel underrepresented. There is often sufficient commonality in the problems of cities and especially urban counties, to justify their grouping together. Yet, counties participating in those transfer networks generally feel that their problems are somewhat different from those of city governments.

Recommendation: When matching up local jurisdictions for certain purposes, such as proof-of-concept testing, lead city/county research and development, and transfer of technology packages, the city-county difference should be taken into account.

User Characteristics. Only two of the five networks use a criterion to identify their target groups. It is questionable whether the population size criterion guarantees sufficient commonality of the participants' problems, needs, and interests. Network users think that the local government form, such as strong mayor or city/county manager form of government, influences the degree of technology utilization and innovation at the local level.

Recommendation: When matching local jurisdictions participating in one network, different criteria such as the growth rate, per capita income, or the population density should be tested concerning their ability to create groups of local governemtns with common problems. The form of local government should also be taken into account when matching up users.

User Status. Network users in one instance complained that only those cities and counties should be selected to participate in the network which truly want to be involved. A membership, it was felt, can insure increased input by local government but also requires active participation in network activities to make the whole venture a success.

A network run on a client basis has to have a sufficient amount of requests for assistance to justify its structure and pay for its ongoing operation. A membershiptype operation can rely on a certain based amount of financial support to maintain a desirable continuity in its work. It also stimulates the network participants (1) to use the services and (2) to actively influence the network's policies and goals.

Recommendation: A new free-standing network should operate on a membership basis unless it can rely on a regular stream of financial support from other sources such as state and/or federal government.

Network Coverage. No particular preference was voiced regarding this item. However, one can easily see that supra-state, regional, state and substate network coverage can help insure an increased commonality of network users' problems. Climate, topography and other physical factors can play a role. Moreover, rules, regulations, and laws enacted at the state level governing certain local activities cause additional uniformity of problems.

Some of the possible advantages of a national network are:

(1) greater science and technology resources;

(2) minimum duplication of local governments' efforts;

(3) greater chances of successful replication of experiences

Recommendation: None.

Services

Amazingly few comments were received concerning this category. It was felt that the services should be as comprehensive as possible. Emphasis was put on an ongoing problem identification and needs assessment process based on an active participation of local governments.

Technology Types. The Center for Local Government Technology and the

Georgia Innovation Group slightly prefer soft-technologies over hard-technologies as objects of their activities. The three other networks maintain a balance between hard and soft technologies and in certain cases specialize even in hard technologies.

Recommendation: No technology type should be especially preferred. Emphasis should be placed on the "technology-content" of the services or products provided by the urban information and technology transfer networks.

Activity Types. Several comments were concerned with the effectiveness of written communication to transmit technical information. They said the paper method of transferring information is not the best way, but rather national conferences on local problems of broad interest should be planned.

To maintain a continuing problem identification and needs assessment process at the local level was felt to be important. The needs list which is being developed at the local level is a guide in searching for appropriate technology-solutions. This search is often unsystematic and not comprehensive enough. Computerized information systems in addition to informal personal communication, usually provide references to reports and documents. But in the context of assisting local governments on a day-to-day basis, reports and documents are not too helpful. Information is needed on where a similar problem has occured and who is researching and developing solutions in the problem area. Through telephone conversations, rather than formal literature searches many of the day-to-day problems can be solved.

Recommendations: To achieve a better information flow in urban information and technology transfer networks national conferences on local technology problems of broad interest should be held on a regular basis. An information system should be developed which is accessible to and has to be updated by all network users. Rather than containing only references to reports

and documents addressing certain problems, it should list individuals and groups which have had some experience within the problem area. (Hatry, 1971)

Operation

Most comments received were directed toward the operation of urban information and technology transfer networks. It was felt in some cases that network administrations should be institutionally as independent as possible Typically, a chartered not-for-profit organization outside the civil service control would achieve this. The technology agent/science advisor concept is believed to help ensure a viable and successful technology transfer operation. The pull process as a way to obtain technology for local government problem-solving was considered the only acceptable process leading to the best results.

Network Administration Types. In the case of national networks, the most suitable type of administration is a non-profit operation. At the state level, three administration types are possible and are being used. Network users think that an independent organization can avoid the rigidities of civil service and by-pass the dogmas and traditional positions of the bureaucracy. A not-for-profit administration type can pursue its goals and objectives independently of political terms and considerations. It can more effectively link federal, state, local and university problem solvers. It has to be noted, though, that the administration type does not necessarily affect the network-to-user relationship.

Recommendation: To ensure an effective, independent network operation, the network should be organized as a chartered not-for-profit operation.

Guidance. Network users indicated that an advisory body is a necessary feature of any kind of network operation. All of the five networks discussed rely to varying degrees upon their advisory bodies whose membership characteristics differ too. Local government representation on the advisory body is required in

all five cases. In some cases it was felt that representation by private industries and research and development groups, in additon to user reresentation, could enhance the efficiency of the network operation.

Recommendation: The advisory body should consist of representatives of those groups which the network is serving.

Linkage Types. A linkage between network user and network office through a person, such as a technology agent, science advisor, extension agent, or local government representative, is a successful and effective concept. The linkage person can actively stimulate technology utilization in local governments, raise the awareness of local officials with respect to technology available, and assist in securing information about technologies and their application in the public sector. The linkage person is responsible for technology innovation, changes in the respective local government and demonstrates the benefits of utilizing technology products and advanced methods and procedures. It was felt that the linkage person, being highly visible in its role as technology agent, did not assume in most cases, a technology leadership role by utilizing sophisticated technology. How can people believe in increased technology utilization, it was wondered, if the forerunners, namely the technology agents or representatives do not use technology to facilitate their jobs and improve their performance?

With respect to the research and development back-up site, e.g. a university, private technology firm, or federal laboratory, the following comments were received. Universities as back-up support have created some problems. Their traditonal research and development role is long-range, publishable research. Unless the local goverment in need of technical assistance can approach the university back-up site with a well-defined, specific project, the university usually is not very cooperative. Universities are usually not flexible and

responsive enough to answer urgent requests by local governments for short-term technical assistance.

To alleviate this problem some universities have established separate units, which provide short-term technical assistance and consulting services to the public and the private sector. Examples are the Engineering and Experiment Station at the Georgia Institute of Technology, the Research Triangle Institute in North Carolina, the Center for Local Government Technology at the Oklahoma State University and the Agricultural Extension Service Offices at many state universities.

The type of back-up site and its field of specialization influence the type of technical assistance provided to the local government. The responsiveness to local governments; needs will vary from back-up site to back-up site, as will the appropriateness of a response to a local request. The geographical distance between a local government and its back-up site has also created some communication problems in the past.

Recommendations: The technology agent and representative should utilize as much technological innovations as possible. Particularly in the fields of project management, communications and information storage, retrieval and dissemination the technology agent should demonstrate the benefits of utilizing improved methods and high technology products. The technology agent should set an example.

Local governments and their technology agents should be able to contact different levels of technical specialization and advice in a certain problem area according to the complexity of the local problem. Obvious overkills by research and development resources of the back-up site have occured. A technology generalist is sufficient for many local governments' requests.

Instead of one back-up site per network user, the technical advisory and assistance resources should be grouped by field of specialization. The technology agent then can tap the respective pool if confronted with a special problem.

At least one contact of each back-up pool should be located near a local government using the network.

Transfer Process Type. All five networks were specifically designed to incorporate the pull process as the transfer process type. Past experience of federal technology transfer programs has proven the push process to be less effective in increasing the technology utilization in the public sector.

Recommendation: Urban information and technology transfer networks should employ a pull process to achieve their objectives and goals.

External Linkages. Urban information and technology transfer networks can only succeed if they maintain close contact and cooperate on a continuing basis with other organizations and government agencies. It was felt that greater advantage should be taken of the accomplishments, techniques, and resources available from several mission agencies' technology transfer programs .

Comments were received critiquing the overlap and duplication of some networks' efforts with those of the functional committees in the municipal public interest organizations. It was also strongly emphasized that the networks should use existing information dissemination and problem identification capabilities of general public interest groups and professional associations.

Recommendation: Networks should make full use of existing resources and expertise in the field of technology transfer, and existing communciation structures of public interest groups and professional associations. Networks should cooperate and coordinate their activities with functional committees in municipal public interest organizations.

CHAPTER V

DESIGN OF AN ALTERNATIVE URBAN INFORMATION AND TECHNOLOGY TRANSFER NETWORK

Description of Main Components

The criticism and recommendations presented in the previous chapter revolved around serveral major issues:

(1) Utilization of a technology information system by the technology extension agent or network office;

(2) Cooperation and communication with existing human resources;

(3) Utilization of existing communication channels and mechanisms;

(4) Pooling of research and development back-up support by field of specialization.

These issues will lead to the design of four building blocks which will be used as the main components for the alternative network. The design will be schematic rather than detailed (Figure V-1). It should also be noted that the components are dependent on each other and need to be employed together to guarantee an effective and efficient operation of the network.

Technology Information System (TIS)

The Technology Information System will be the backbone of the network's operations. A high percentage of urban information and technology transfer networks' activities consist of providing information on what technologies are available, from where, their costs, applications, and potentials. The concept of incorporating a computerized information system accounts for this. Accessible to all network participants through an on-line computer facility, the system will improve the overall communication and information sharing within the network.

Nature of Information. Unlike most other information systems which list bibliographical referenceS when given certain key-words according to field of interest, the TIS will be used predominantly as a computerized directory. Names, addresses, and telephone numbers will constitute most of the information stored in the TIS. This information will be available in files separated by technology suppliers, research and development organizations (public and private), and local governments. The files themselves will be keyed by product/service- type, field of specialization, and type of technology innovation implemented. In addition to the personal data, a brief abstract on each product/service, each specialization/nature of research, and technology innovation implemented will be given. Moreover, interfaces with other inromation systems listing biographical references can be envisioned. Another type of information which will be stored in the networks' Technology Information System is the local governments' needs list.

Sources of Information. Sources of information for the TIS would be:

(1) Technology Suppliers which want to list their products, services, and localities in which they have been successfully applied;

(2) Research and Development Organizations which are engaged in local government-related technology R&D. Data could possibly be obtained through a cooperation with the National Technical Information Service, Department of Commerce;

(3) Local Governments describing their experience with certain technology innovations and giving information on the technology supplier and/or R&D organization;

(4) Federal Government Mission Agencies supplying data or urban technology-related programs and their participants;

(5) Public Interest Groups and professional associations;

(6) Other technology information systems.

Operation. TIS should be operated as a separate entity of the network's central office.[1] The TIS staff will update and maintain the files on a regular basis. Updates of the needs list of network-participating governments will be are initiated from the central office. The same procedure will be followed in case of successful technology innovations as following replications thereof in other locations. The appropriate "local government file" will then be updated.

In case a problem occurs at the local level the technology agent, extension agent, or even the network office consults the TIS. Depending on the nature of the problem, one might find an answer, a reference , a person who can be contacted to obtain the answer needed, or further advice and guidance on how to proceed with the problem.

Examples. The San Diego Technology Action Center (SANDTAC) has implemented an information system for its own use. SANDTAC provides technical asssistance and information to the City of San Diego. SANDTAC also operates a technology transfer program for the City and is a member of the California Innovation Group. SANDTAC has created computerized files to store requests for assistance, information on the Center's technical support activities, and specific technical notes. (SANDTAC 77, p. 29)

The International City Management Association (ICMA) provides a management information service. In a bimonthly guide fifty to sixty capsule reports on actual innovative projects and programs in local governments are presented. Each contains the most important information on the experience, gives

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[1] A technology information system could serve all urban information and technology transfer networks, as well as other interested local, state governments, or divisions thereof. This system, like other information systems, could be operated on a cost-per-services-received basis.

the name of the jurisdiction involved, its population size, as well as a contact person's name, phone number, and address to contact for further information. The reports are grouped by functional areas of the local governments. This system could be computerized and represents essentially the kind of information that should be contained in the TIS-local government file. (ICMA, 1977)

Control Data Corporation operates TECHNOTEC and WORLDTECH data banks, which were designed to provide a fast and economical means for the worldwide transfer and exchange of technology, ideas, patents, and processes. The computer-based TECHNOTEC is comparable to a newspaper classified advertising system with three sections: technology wanted, technology for sale, and technologist expertise available. Persons seeking technology explore the data base from a remote terminal until a sufficient number of key-word "matches" occur, at which time they may request the name and address of the seller for further information or a business arrangement. The data base also contains a list of individuals or organizations with particular expertise that may be required in transfering technology. (Donaldson, pages 86-88)

Science and Technology Advisory Groups (STAGs)

The Science and Technology Advisory Groups, consisting of members of the professional and academic communities in network-participating localities will assist their respective local governments in matters related to urban technology and its utilization.

Membership. Participation in Science and Technology Advisory Group activities is voluntary. Members of the STAGs will come from various professions whose activities, scope, and nature are related to urban problems and local government decision making. Colleges, universities, businesses, and research institutions are valuable sources for this scientific and technological manpower.

Recruitment. Members for the STAGs will be recruited by:

(1) Directly contacting colleges, universities, appropriate businesses, and research institutes

(2) Contacting appropriate professional associations to make their members aware of the STAGs at the local level and encourage them to participate in providing a reasonable amount of free time to the advisory group in their locality.

(3) Announcing in the local media the concept of the STAGs, their functions, responsibilities, and rewards for participating members.

Operation. STAGs can use different operational forms depending on the type of local government served, size of the locality, and nature of problems in the technology area. STAGs can be very informal. When major technologyrelated decisions are to be made by the local government, they can meet on an ad-hoc basis. At other times STAG-members can be contacted individually if advice is needed on smaller technology issues. In other cases, where the professional community is large enough and sufficient interest is expressed by the local government, the STAGs can be formally organized as regularly meeting advisory bodies to local governments. They can employ a committee structure to accommodate the various local government departments. Department heads can chair the respective STAG-committees. Professional organizations can have local chapters participate in the advisory groups.

Thus, a multitude of arrangements can be envisioned to best fit local government preferences and situations.

Function. Since professionals participate in STAG activities on a voluntary basis, the problems and projects to be considered by the Groups should be consistent with the group members professional interests so that the efforts in

advising the local governments are relatively small. STAGs will organize and rank by priority the problems of the functional departments. The STAGs will then try to solve the problems. Problems should be carefully selected to insure a high susceptibility to technical solutions and their feasibility. Their feasibility should be considered both from a technical point of view and in terms of the resources needed to solve the problems.

Examples. The Rochester/Monroe County Technology Transfer Program uses the professional technology advisory group concept. The Rochester Engineering Society, as a principal representative of the area's engineering and technical community, works closely with the Rochester City manager and the Monroe county manager. Together, they are trying to establish an appropriate mechanism to link the human technological resources of the community to those persons and organizations within the local government that can best utilize technology. (Rochester, p. 1)

The San Diego Technology Action Center considers the professional societies in its area an important resource which has potential for assisting local governments in highly technical areas. SANDTAC has established a working relationship with the engineering societies in the San Diego area and selected members, with certain urban technology specialty areas, have volunteered to be available. They also serve on ad-hoc committees if needed. (SANDTAC 77, p. 24)

The Mayor's Science and Technology Advisory Council represents the approach taken in the City of Philadelphia. M-STAC operates six committees and relies on a pool of 170 professionals from various fields of specialty for advice and cooperation. (Urban Technology, 1973, p. 1)

Other programs which employ the same concept of voluntary assistance and advice by professionals and executives are the Executive Loan Program and

the New York Arts and Business Council Program. Under the Executive Loan Program, private business executives are placed into local governments while still on their companies' payrolls to introduce innovation and assist in solving major problems. The New York Arts and Business Council's skills/services/resources bank matches financially troubled arts groups with volunteer problem-solvers from the corporate community. (Staging Rescues, 1978)

Professional Associations and Public Interest Groups

Professional associations and public interest groups related to local governments will provide financial and manpower support to the network's central office. The network in pursuing its functions can utilize the associations' and interest groups' communication channels to reach local government representatives, decision makers, and local officials. Educating them on potential applications and benefits of technology in the public sector in general, disseminating information on successful experiences, and receiving feedback on the network's programs and activities are functions which can be facilitated by this. Moreover, the associations and interest groups can use their channels and mechanisms to influence federal policies related to local government technology transfer and utilization.

The professional organizations will also maintain the necessary contact with their members and chapters at the local level concerning the role, function, and activities of the Science and Technology Advisory Groups.

Operation. The network will be a chartered non-profit organization. It will be run by a board of directors consisting of representatives of various potentially urban-technology related professional organizations and public interest groups such as the International City Management Association (ICMA), American Public Works Association (APWA), National Police Officers Association, National

Fire Fighter Association, American Society of Planning Officials (ASPO), American Institute of Planners (AIP), American Society of Civil Engineers (ASCE), Institute of Electrical and Electronic Engineers (IEEE), United States Conference of Mayors (USCM), National League of Cities, and the National League of Counties.[1] The board will be chaired by the representative of the ICMA since it already runs an effective information dissemination program on innovations. Thus, it has experience in technology transfer and utilization. Moreover, an ICMA-chairperson adds credibility to the network operation based on the peer group concept. The board will give the necessary policy guidance to the network office and establish the activity- and program-priorities.

The network office will be headed by a director, hired on a competitive basis. The network office staff will consist of representatives of the various professional associations. The staff members have to be qualified professionals with special interest, knowledge, and experience in local technological needs and problems.

Function. The network office will provide the necessary linkages among research and development back-up support, local governments, Technology Information System operation, and professional associations and public interest groups. The network office is also responsible for securing grants for major

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[1] ICMA operates a management information service emphasizing local government innovations. APWA had plans to establish a Public Works Technology Coordination System which was supposed to actively support technology transfer and utilization at the local level. IEEE had plans for an Urban Science and Technology Program which was based on Computer Society's local chapter's support to local governments in the field of computer-related technology.

research and development projects based on local governments' needs. The office will also package innovative technologies successfully applied in one location to transfer it to other sites. The TIS will assist the office in locating and selecting potential replication sites. The office will help to update the TIS on an on-going basis.

Research and Development Back-Up Pool

Back-up sites will be pooled by area of specialization. The TIS will assist the local government trying to locate appropriate advice and solutions to select an appropriate R&D organization. Requests by local governments which require only little effort by the back-up site will be handled directly on a cost basis. The request, back-up site's name, and answers will be stored in TIS for future reference and utilization by other network-users. If the request requires substantial efforts, it will be placed with the network office for future consideration, financial support arrangements, and state-of-the-art searches in the specific problem area.

Component Interaction

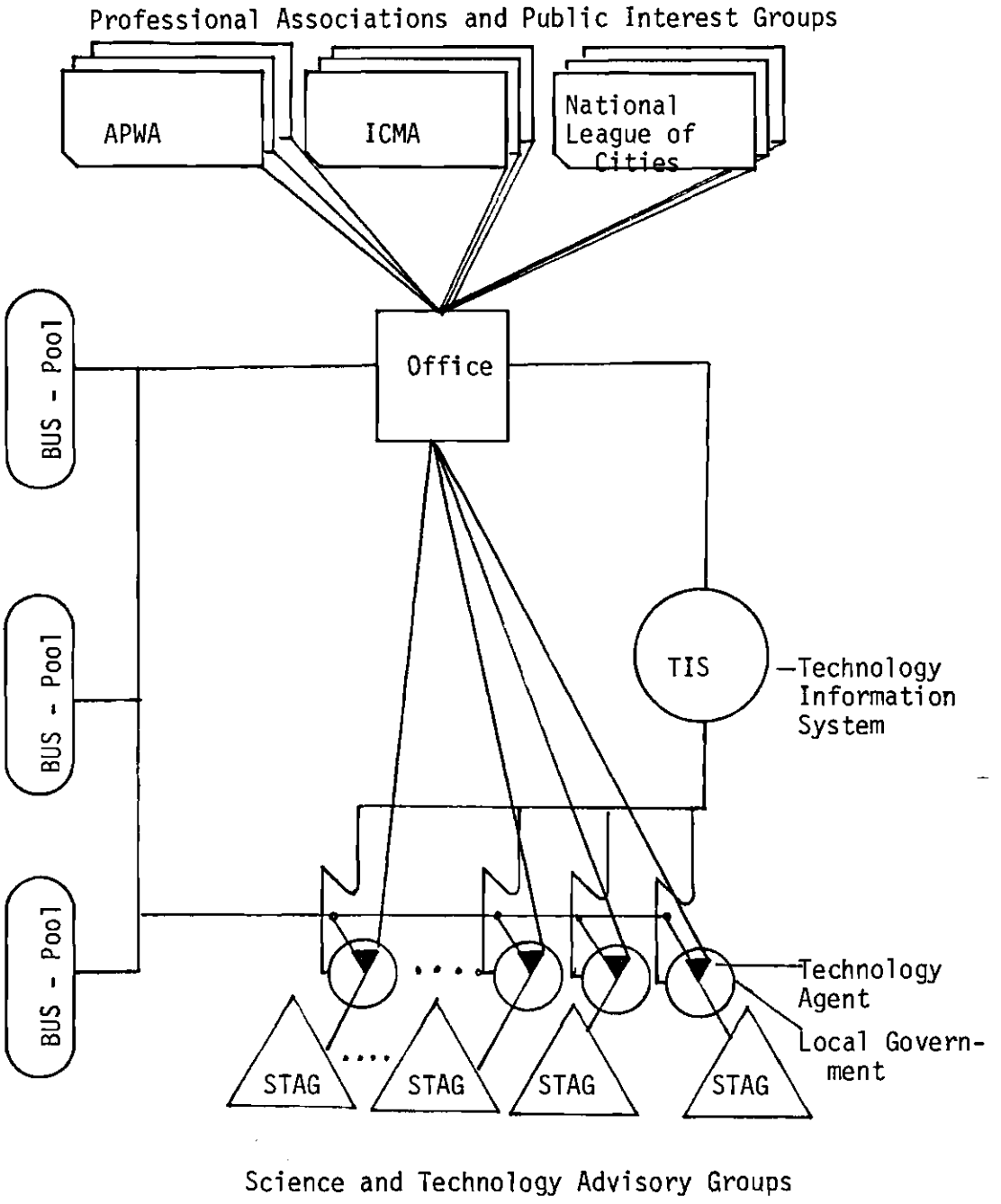

Figure V-1. Organizational Structure of the Alternative Network

Typology-Related Design

In the following, the recommendations developed in the previous chapter will be used to define the typology-related characteristics of the alternative network. The typology will serve as a checklist while describing the characteristics. Yet only those items of the checklist which relate to the four major network components introduced earlier will be discussed in detail.

Typology Items / Network Components	User	User Type	User Characteristics	Services	Activity Types	Operation	Network Admin. Types	Guidance	Linkage Types	External Linkages	
TIS		x	x		x				x	x	
STAGs					x			x	x	x	
Professional Assoc. PIGs					x		x	x	x	x	
BUS-Pool					x				x	x	

Figure V-2. Relationship Between Typology Items and Proposed Major Network Components

User

The Technology Information System will play an important role in grouping local governments, matching up local jurisdictions, and testing the effectiveness of various criteria. To achieve a high problem and need commonality within the local government groups, criteria such as growth rate,

population density, and per-capita income will be applied.

User Types/User Characteristics. The local government and its technology representative identify themselves to the TIS each time they perform a search for available technology with the TIS, place a request for needed technology, enter a need statement, or describe an innovation or answer found. The identification information will be stored with every operation performed on the TIS. It can be used later to group and match local governments, analyze the kind and scope of requests placed and correlate them with the specific characteristics of the user, and develop needs and problems lists for different groups of local governments.

User Status. The alternative network, under the guidance of professional associations and local government-related public interest groups will operate based on a membership of local governments.

Network Coverage. In order to make best use of the resources available, and assisted by a comprehensive technology information system, the alternative network will operate on the national level.

Services

Technology Types. Both hard and soft technologies will be equally sponsored by the alternative urban information and technology transfer network.

Activity Types. The STAGs will assist local governments in identifying their problems and assessing their needs. The advisory groups will cooperate with local department heads in producing a list of problems to be tackled. This list will be placed into the TIS to allow technology suppliers to locate jurisdictions where their products and services might be needed. This marketing aspect of the TIS, and the market aggregation effect it can have by providing information on technology needed by groups of local governments, make it an integral part of the alternative network's activities.

Technical information and assistance will be provided from various sources. The TIS, STAGs, and research and development back-up support will respond to requests for assistance according to the complexity of the problem to be solved. Technical assistance requests can range from simple questions, requiring only a minimum of time, to complex research problems, with substantial funding and time involved. Requests will be classified and dealt with in the following manner:

(1) Simple request: The technology agent or local government technology representative investigates and contacts STAG.

(2) Medium-Difficult Request: The technology agent consults the TIS and possibly contacts by phone the appropriate person/organization found in the references.

(3) Difficult Request: The technology agent uses the TIS to find appropriate contact in the R&D back-up support pools. He contacts the organization(s) and obtains answers.

(4) Very Difficult Request: Long term research is needed. The technology agent contacts the network office. The office will formalize a proposal and try to find financial support for an organization to perform the research and/or development of the product/service needed. Very difficult requests will usually end in a demonstration program and proof-of-concept testing in one locality. Replication assisted by the TIS will be used to initiate a successful innovation in other locations.

All these activities will be supported by national conferences on local technology problems and successful innovations. The conferences can be effectively implemented utilizing the ties the network office maintains with professional organizations and public interest groups.

Operation

Network Administration Types. The alternative network will be chartered as a non-profit organization with professional association-and public interest group-affiliations.

Guidance. Guidance will be provided to the network at the local level by the Science and Technology Advisory Groups which will consist of professionals with a variety of backgrounds and professional and academic affiliations. At the national level the networks' operations will be guided by the board of directors, representing the different professional associations and public interest groups involved in the alternative network.

Linkage Types. The alternative network will not prescribe any particular linkage type. All network-to-user linkage types can occur depending on the political and financial situation of the participating local government. The network can accommodate the technology agent-, local government representative-, and even the Extension Agent- concept. In the latter case the extension office can form the intermediate link between individual users and the overall network. The flexibility in linkage types is made possible by the communication and information system used. The TIS and the STAGs make individual local governments fairly independent of a given network structure.

With respect to the user-back-up support linkage, both types are possible and will be used. As described under the Activity Types, the local governments can contact the back-up support pools directly for certain requests. In cases of very difficult requests, requiring substantial research and development efforts, local governments will approach the network office for further action.

By using pools of specialized back-up organizations, the problem of geographical proximity of the back-up support to the local government needing

technical assistance is reduced. Moreover, pooling by specialization and classifying requests by complexity eliminate the possible discrepancy between the complexity of problem and the research and development resources applied to it.

Transfer Process Types. The alternative network will predominantly utilize a pull process.

External Linkages. The network will maintain linkages with professional associations and public interest groups. Ties with private industry, business, universities and research institutes exist through the back-up support pools, the TIS, and the STAGs at the local level.

CHAPTER VI

RECOMMENDATIONS AND FUTURE OUTLOOK

The five previous chapters demonstrate that by studying existing systems, their components, interaction and operation, a framework can be developed which guides the design of an alternative system. This system contains successful features of the existing systems and combines them with new ideas into a more advanced network.

The typology developed in this thesis describes the predominant characteristics and features of operational urban information and technology transfer networks. It was used as a checklist to ensure a complete and comprehensive design of an alternative network. The typology in itself, although fairly coarse, constitutes an agenda for future research in the field or urban information and technology transfer networking. As shown, it can be used as a framework to evaluate the operation of existing transfer networks.

An attempt is made to relate the characteristics and features of operational networks to their specific goals and objectives. It is shown that design features vary depending on network-user characteristics and other factors directly related to networks' goals and objectives. Although this attempt is only at a descriptive level, it becomes obvious that a greater flexibility is desirable in the networks' operations to accommodate a variety of different local government users.

Specific recommendations for improvements and modifications are given related to the concept of technology transfer networks and the characteristics and features of operational networks. (1) It is recommended to utilize existing

communication and cooperation mechanisms to disseminate information to and solicit feedback from local government users, (2) to more efficiently utilize existing human and technology resoruces, including the professional community and computerized information systems, and (3) to group and match jurisdictions in a more flexible way.

The design of an alternative network relies heavily on a technology information system as one component. It is essential to the network's performance. Yet, it can also be envisioned as a support component to the existing operational networks. The potentials of such an information system, its integration into the networking process, and the details of its design are subjects for future research. It is believed that a technology information system if properly designed, constantly updated, and appropriately managed, will change the character of existing urban information and technology transfer networks from technology utilization policy oriented to solely technology transfer and utilization oriented operations. It is felt that this change will be a positive one leaving the policy issues to the traditional public interest groups representing local governments. A clear functional separation of policy influencing from actual technology implementation will improve the overall urban information and technology transfer environment. Yet, this shall not imply a decrease in emphasis on technology utilization in local governments at either the policy or the actual implementation level.

The science and technology advisory group concept, as the second component of the alternative network, has certain limitations due to its voluntary membership. But in various instances, it has proven to be very effective . The concept is flexible and not dependent on the design of the alternative network. Essentially, it helps to decentralize the network operation by strengthening the

information and technology transfer capabilities at the local level. Existing networks can organize science and technology advisory groups for local governments and, thus, increase the responsibility and involvement of the local government.

The two remaining design components, the incorporating of strong ties to professional associations and public interest groups into the network organization, and the pooling of research and development back-up support, should be further evaluated. The pooling concept can be tested within the framework of existing networks.

The alternative network is flexible enough to accommodate existing design features of other urban information adn technology transfer networks. It can be, with relative ease, incorporated into the existing transfer scene. It also has the potential of combining the existing networks into one conglomerate, making the most efficient and effective use of structures, mechanisms, technologies, services, and manpower in the area of urban information and technology transfer.

APPENDIX I

List of Persons Interviewed

Mr. Robert Havlick	Principal Investigator	PTI/UC
Mr. John Parker	Director	PTI/UC
Mr. James Mercer	Former Director Manager	PTI/UTS Battelle Southern Operations
Mr. Stanley Goldberg	Director	PTI/UTS
Mr. James Shamblin	Director	CLGT
Mrs. Doris Willmer	Member Head, Public Technology Group	GIG/IUTF Georgia Tech
Mr. D. DelaBarre	Program Manager	CIG
Ms. Anna Aiello	Program Manager Division of Intergovernmental Science and Public Technology	NSF
Mrs. Dorothy Bomberger	Program Manager	IEEE

APPENDIX II

Glossary of Abbreviations

AIP	American Institute of Planners
APWA	American Public Works Association
ASCE	American Society of Civil Engineers
ASPO	American Society of Planning Officials
CIG	California Innovation Group
CLGT	Center for Local Government Technology, Oklahoma State University
DHUD	US Department of Housing and Urban Development
DOC	US Department of Commerce
DOE	US Department of Energy
DOT	US Department of Transportation
EPA	Environmental Protection Agency
GIG/IUTF	Georgia Innovation Group/Inter-University Task Force
ICMA	International City Management Association
IEEE	Institute of Electrical and Electronics Engineers
ISPT	Intergovernmental Science and Public Technology
NASA	National Aeronautic and Space Administration
NSF	National Science Foundation
PIGs	Public Interest Groups
PTI	Public Technology, Inc.
R&D	Research and Development

R&D BUS	Research and Development Back-up Site
RANN	Research Applied to National Needs
SANDTAC	San Diego Technology Action Center
STAG	Science and Technology Advisory Group
TA	Technology Agent
TIS	Technology Information System
UC	Urban Consortium for Technology Initiatives
USCM	United States Conference of Mayors
UTS	Urban Technology System

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